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NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

EXAMINER	
AYAD, TAMIR	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/586,648	YAMANAKA ET AL.	
	Examiner	Art Unit	
	TAMIR AYAD	1725	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 March 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *32-61* is/are pending in the application.

4a) Of the above claim(s) *58 and 59* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-57,60 and 61* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claims 32-57 and 60-61 are objected to because of the following informalities: claim 32 recites the limitation “the side of the transparent substrate" and “the side of the supporting substrate" in lines 16 and 17. There is insufficient antecedent basis for these limitations in the claim. For the purpose of this office action, the limitations will be treated as if they recite “a side of the transparent substrate” and "a side of the supporting substrate".

Appropriate correction is required.

2. Claim 34 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 32-57 and 60-61 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably

convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Specifically, claim 32 requires that the first and second photoelectric conversion elements differ in order that they provide "the same amount of electric currents".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 32-34, 40-47, 49-50, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaudiana et al. (US 2003/0140959) in view of Wanlass (US 5,322,572).

Regarding claims 32 and 34, Gaudiana '959 discloses a dye-sensitized solar cell module comprising: first photoelectric conversion elements (second and fourth cells from the left in Fig 5I) each comprising a transparent conductive layer ([0076] L3 – 105 in Fig. 5I), a porous photoelectric conversion layer adsorbing a dye ([0076] L7 – 165 in Fig. 5I), an electrolytic layer ([0079] L2 – 185 in Fig. 5I), a catalyst layer ([0079] L6 – 170 in Fig. 5I), and a conductive layer ([0079] L5 – 152 in Fig. 5I) laminated in this order on a transparent substrate ([0076] L1); second photoelectric conversion elements (first and third cells from the left in Fig. 5I) each comprising a transparent conductive layer (105 in Fig. 5I), a catalyst layer (170 in Fig. 5I), an electrolytic layer (185 in Fig. 5I), a porous photoelectric conversion layer adsorbing a dye (165 in Fig. 5I), and a conductive layer (152 in Fig. 5I) laminated in this order on a transparent substrate ([0076] L1); a supporting substrate formed on the respective conductive layers of the first and second photoelectric conversion elements (100 in Fig. 5I), wherein one or more first photoelectric conversion elements and one or more second photoelectric conversion elements are alternately arranged in parallel between the transparent substrate and the supporting substrate (shown in Fig. 5I), and the neighboring first photoelectric

conversion elements and second photoelectric conversion elements are electrically connected in series ([0071] L10-11); a side of the transparent substrate is a light receiving side (this limitation is inherent in the disclosure of Gaudiana '959 because a side of the transparent substrate disclosed is necessarily a light receiving side).

Regarding the limitation "a side of the supporting substrate is a non-light receiving side", the limitation is directed to the manner in which the claimed device is intended to be used. The supporting substrate disclosed by Guadiana has four sides. If the device disclosed by Guadiana is operated outdoors in a day-night condition, during the night hours all four sides of the supporting substrate are non-light receiving sides. Further, regarding the left and right sides of the supporting substrate specifically, even in the day condition, the device of Gaudiana '959 can fully function as designed with the left and right sides of the supporting substrate being non-light receiving sides and only the bottom side being a light-receiving side. A recitation directed to the manner in which a claimed apparatus is intended to be used does not distinguish the claimed apparatus from the prior art, if the prior art has the capability to so perform. See MPEP 2111.02, 2112.01 and 2114-2115.

Gaudiana '959 does not explicitly disclose the first photoelectric conversion elements and the second photoelectric conversion elements are different in at least one among the composition of the electrolytic layers; the thickness of the porous photoelectric conversion layers; the width of the porous photoelectric conversion layers; the average particle diameter of the semiconductor particles composing the porous

photoelectric conversion layers, in order that the first and second photoelectric conversion elements provide the same amount of electric currents.

Wanlass discloses a solar cell module and further discloses first and second photoelectric conversion elements connected in series and further discloses that the device can be optimized by adjusting the areas of the subcells to match the current densities (C8/L51). Wanlass further discloses current matching of two series connected subcells (C2/L56).

Gaudiana '959 and Wanlass are combinable because they are concerned with the same field of endeavor, namely photovoltaic devices.

It would have been obvious to one of ordinary skill in the art at the time of the invention to current match the first and second photoelectric conversion elements disclosed by Gaudiana '959 by adjusting the areas of the photoelectric conversion elements as disclosed by Wanlass, because as taught by Wanlass, the device can be optimized by adjusting the areas of the subcells to match the current densities (C8/L51).

While modified Gaudiana '959 does disclose varying the areas of the photoelectric conversion elements, modified Gaudiana '959 does not explicitly disclose varying the width of the photoelectric conversion layers. However, changing the area of a photoelectric conversion element by varying either the length or the width of the element would have been obvious to one of ordinary skill in the art because in has been held that a change in size (dimension) is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955).

Regarding claim 33, modified Gaudiana '959 discloses all the claim limitations as set forth above.

While modified Gaudiana '959 does not explicitly disclose wherein a short circuit current of the second photoelectric conversion elements in the case where a light receiving face thereof is set in the porous photoelectric conversion layer side opposite the catalyst layer side is greater than a short circuit current of the first photoelectric conversion elements in the case where a light receiving face thereof is set in the porous photoelectric conversion layer side opposite the catalyst layer side, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).

Regarding claim 40, modified Gaudiana '959 discloses all the claim limitations as set forth above. Gaudiana '959 further discloses wherein the photoelectric conversion elements contain lithium iodide in the electrolytic layers thereof ([0032]).

Regarding claims 41-42 and 44-47, modified Gaudiana '959 discloses all the claim limitations as set forth above.

While modified Gaudiana '959 does disclose the desirability of current matching of two series connected subcells (Wanlass - C2/L56), modified Gaudiana '959 does not explicitly disclose the manner in which the series connected cells are current matched.

However, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the surface areas of the light receiving portions of the devices (by adjusting the widths of the photoactive areas), or to adjust the thicknesses of the photoactive layers, or a combination thereof, in order to achieve the desired current matching disclosed by Wanlass for series connected cells, because current output is proportional to the amount of light receiving or photoactive material in a photovoltaic device.

Regarding claims 43 and 49-50, modified Gaudiana '959 discloses all the claim limitations as set forth above.

While modified Gaudiana '959 does not explicitly disclose wherein when the short circuit current density of the first photoelectric conversion elements is defined as Jd and the short circuit current density of the second photoelectric conversion elements is defined as Jc, (Jc/Jd)>0.7 is satisfied, where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).

Similarly, while modified Gaudiana '959 does not explicitly disclose wherein open circuit voltage values of the first photoelectric conversion elements are higher than open circuit voltage values of the second photoelectric conversion elements, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Where the claimed and prior art

products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).

Regarding claim 60, modified Gaudiana '959 discloses all the claim limitations as set forth above. Gaudiana '959 further discloses wherein the catalyst layers contain Pt ([0035]).

9. Claims 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaudiana et al. (US 2003/0140959) in view of Wanlass (US 5,322,572) as applied to claim 34 above, further in view of Boschloo et al. ("Optimization of dye-sensitized solar cells prepared by compression method") and further in view of Gay et al. (US 4,461,922).

Regarding claim 35, modified Gaudiana '959 discloses all the claim limitations as set forth above.

While modified Gaudiana '959 does disclose wherein the first photoelectric conversion elements and the second photoelectric conversion elements contain iodine in the respective electrolytic layers (Gaudiana '959 - [0032]), modified Gaudiana '959 does not explicitly disclose the iodine concentration in the electrolytic layers of the second photoelectric conversion elements is lower than the iodine concentration in the electrolytic layers of the first photoelectric conversion elements.

Boschloo discloses a dye-sensitized solar cell module and further discloses the use of additives to electrolytes that affect the IV characteristics of the device

(P12/C1/section 3.1/L9 - the additives to the electrolyte necessarily changes the concentration of components in the electrolyte solution). Further, Gay discloses the desirability of matching short circuit currents in series connected solar cells (C2/L20).

Gaudiana '959, Boschloo, and Gay are combinable because they are concerned with the same field of endeavor, namely photovoltaic devices.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the additives disclosed by Boschloo in the electrolyte compositions of the respective first and second photoelectric conversion elements of Gaudiana '959, to accomplish the short circuit current matching disclosed by Gay, because as taught by Gay, proper operation of series connected cells requires matching of short circuit currents (C2/L20).

Regarding claim 36, modified Gaudiana '959 discloses all the claim limitations as set forth above.

Modified Gaudiana '959 does not explicitly disclose wherein the ratio M1/M2 of the iodine concentration M1 in the electrolytic layers of the first photoelectric conversion elements and the iodine concentration M2 in the electrolytic layers of the second photoelectric conversion elements is higher than 1 and not higher than 5.

As the IV device characteristics (voltage and current output) are variables that can be modified, among others, by adjusting the type and amount of additives to the electrolyte solution (and resultantly changing said iodine concentration), as evidenced by Boschloo, the precise iodine concentration in the respective electrolyte layers of the first and second photoelectric elements would have been considered result effective

variables by one having ordinary skill in the art at the time the invention was made. As such, without showing unexpected results, the claimed iodine concentrations cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the iodine concentrations (through the inclusion of the additives disclosed by Boschloo) in the device of modified Gaudiana '959 in order to obtain the desired current matching of the series connected cells as disclosed by Gay. (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

10. Claims 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaudiana et al. (US 2003/0140959) in view of Wanlass (US 5,322,572) as applied to claim 32 above, and further in view of Gaudiana et al. (US 2003/0230337).

Regarding claims 37 and 38, modified Gaudiana '959 discloses all the claim limitations as set forth above.

While modified Gaudiana '959 does disclose wherein the first and second photoelectric conversion elements respectively contain imidazolium salts ([0033]), modified Gaudiana '959 does not explicitly disclose the imidazolium salt contained in each of the electrolytic layers of the first photoelectric conversion elements being different from that contained in each of the electrolytic layers of the second photoelectric conversion elements. Further, modified Gaudiana '959 does not explicitly disclose

wherein the imidazolium salts contained in the respective electrolytic layers of the first and second photoelectric conversion elements differ in concentration.

Gaudiana '337 discloses a dye-sensitized solar module and further discloses differing IV device characteristics with differing electrolyte compositions and/or concentrations (Tables 13 and 14).

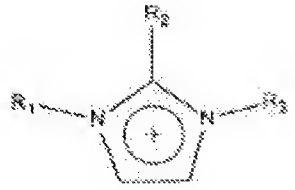
Gaudiana '959 and Gaudiana '337 are combinable because they are concerned with the same field of endeavor, namely photovoltaic devices.

It would have been obvious to one of ordinary skill in the art at the time of the invention to vary the compositions and/or concentrations of the respective electrolytic layers of the first and second photoelectric elements of modified Gaudiana '959 in order to achieve the desirable IV device characteristics for each of the elements, because as taught by Wanlass, it is desirable to current match two series connected subcells for optimal performance (C2/L56; C8/L51).

11. Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gaudiana et al. (US 2003/0140959) in view of Wanlass (US 5,322,572) further in view of Gaudiana et al. (US 2003/0230337) as applied to claim 37 above, and further in view of Chiba et al. (US 2002/0134426).

Regarding claim 39, modified Gaudiana '959 discloses all the claim limitations as set forth above.

Modified Gaudiana '959 does not explicitly disclose wherein the imidazolium salts are salts of compounds defined by the formula:



wherein R_1 and R_2 independently denote a hydrogen atom or methyl; R_3 denotes methyl, ethyl, propyl, butyl, or hexyl.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein the imidazolium salt is dimethylpropylimidazolium iodide ([0066]).

Gaudiana '959 and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include the imidazolium salts disclosed by Chiba as the imidazolium salts taught by modified Gaudiana '959, because as taught by Chiba, the dye-sensitized photovoltaic cell disclosed can conduct photovoltaic conversion of light of a wide range of spectrum from the visible region to the near infrared region in the sunlight spectrum and provides a photovoltaic cell having high efficiency by improving J_{SC} ([0011]). Further, the use of the imidazolium salt disclosed by Chiba amounts to the use of a known compound for its intended use in a known environment to accomplish an expected result.

12. Claims 48 and 51-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaudiana et al. (US 2003/0140959) in view of Wanlass (US 5,322,572) as applied to claim 32 above, and further in view of Chiba et al. (US 2002/0134426).

Regarding claim 48, modified Gaudiana '959 discloses all the claim limitations as

set forth above.

Modified Gaudiana '959 does not explicitly disclose wherein a first dye is adsorbed in the respective porous photoelectric conversion layers of a plurality of the first photoelectric conversion elements and a second dye different from the first dye is adsorbed in the respective porous photoelectric conversion layers of a plurality of the second photoelectric conversion elements.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein a first dye is adsorbed in the respective porous photoelectric conversion layers of a first photoelectric conversion element and a second dye different from the first dye is adsorbed in the respective porous photoelectric conversion layers of a second photoelectric conversion element ([0027] L4-6).

Gaudiana '959 and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the first and second dyes as disclosed in Chiba, in the device of modified Gaudiana '959, because as taught by Chiba, the dyes have different maximum sensitivity wavelength regions ([0027] L5) which would maximize light absorption.

Regarding claims 51, modified Gaudiana '959 discloses all the claim limitations as set forth above.

Modified Gaudiana '959 does not explicitly disclose wherein the average particle diameter of the semiconductor particles of the porous semiconductor layers of the first photoelectric conversion elements is smaller than the average particle diameter of the

semiconductor particles of the porous semiconductor layers of the second photoelectric conversion elements.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein the average particle diameter of the semiconductor particles of the porous semiconductor layers of the first photoelectric conversion elements is smaller than the average particle diameter of the semiconductor particles of the porous semiconductor layers of the second photoelectric conversion elements ([0011]).

Gaudiana '959 and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include the semiconductor particles with different average particle diameters in the first and second photoelectric conversion elements disclosed by modified Gaudiana '959, as disclosed in Chiba, because as taught by Chiba, photovoltaic conversion of light of a wide range of spectrum is enabled and J_{SC} is improved which improves photovoltaic cell efficiency ([0011]).

Regarding claim 52, modified Gaudiana '959 discloses all the claim limitations as set forth above. Additionally, Chiba further discloses wherein the porous semiconductor layer of a photoelectric conversion element is composed of a plurality of layers and the average particle diameter of the semiconductor particles in the porous semiconductor layer closest to the supporting substrate is larger than the average particles diameter of the semiconductor particles in the porous semiconductor layer farthest from the supporting substrate ([0011]).

Regarding claims 53 and 54, modified Gaudiana '959 discloses all the claim limitations as set forth above. Additionally, Chiba discloses wherein the porous semiconductor layer of each of the photoelectric conversion elements is composed of a plurality of layers and the semiconductor particles with a particle diameter of 100 nm or larger (Chiba – [0081] L3) are contained in the porous semiconductor layer closest to the supporting substrate and the semiconductor particles with an average particle diameter of 30 nm or smaller (Chiba – [0077] L10) are contained in the porous semiconductor layer farthest from the supporting substrate [0011]).

13. Claims 55-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaudiana et al. (US 2003/0140959) in view of Wanlass (US 5,322,572) as applied to claim 32 above, in view of Lindquist et al. (WO 99/63599).

Regarding claim 55, modified Gaudiana '959 discloses all the claim limitations as set forth above.

Modified Gaudiana '959 does not explicitly disclose wherein the light transmittance of the catalyst layers of the second photoelectric conversion elements is lower than the light transmittance of the catalyst layers of the first photoelectric conversion elements.

Lindquist discloses a dye-sensitized solar cell module and further discloses wherein the shapes of the catalyst layers of first and second photoelectric conversion elements differ (P5/L11, P5/L14, Figure 1).

Matsui and Lindquist are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the catalyst layers of Matsui such that their shapes differ as disclosed in Lindquist, because as taught by Lindquist, the semiconductor layers have different bandgaps (abstract L30) and therefore adjusting the shapes of the catalyst layers as disclosed by Lindquist would allow differing amounts of light as desired for different bandgap semiconductor layers.

With regard to the recitation wherein the light transmittance of the catalyst layers of the second photoelectric conversion elements is lower than the light transmittance of the catalyst layers of the first photoelectric conversion elements, one of ordinary skill in the art at the time of the invention would have found it obvious to rearrange and match the differently shaped catalyst layers disclosed by Lindquist to achieve the desired match with the various wavelengths of absorption targeted in the respective semiconductor layers disclosed in modified Gaudiana '959.

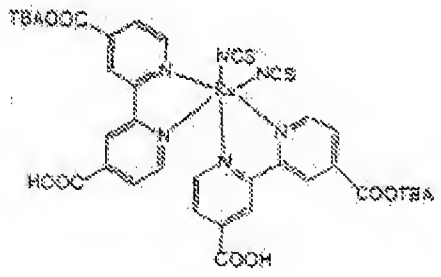
Regarding claim 56, modified Gaudiana '959 discloses all the claim limitations as set forth above. Modified Gaudiana '959 further discloses wherein the catalyst layers of the second photoelectric conversion elements have apertures (inherently disclosed – layers necessarily have apertures on a molecular level).

Regarding claim 57, modified Gaudiana '959 discloses all the claim limitations as set forth above. Modified Gaudiana '959 further discloses wherein the catalyst layers of the second photoelectric conversion elements have a lattice-like shape (inherently disclosed – the catalyst layer disclosed, as a layer comprised of molecules arranged together, necessarily has a lattice-like shape).

14. Claim 61 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gaudiana et al. (US 2003/0140959) in view of Wanlass (US 5,322,572) further in view of Chiba et al. (US 2002/0134426) as applied to claim 48 above, further in view of Nazeeruddin et al. ("Investigation of Sensitizer Adsorption and the Influence of Protons on Current and Voltage of a Dye-Sensitized Nanocrystalline TiO_2 Solar Cell"), and further in view of Grätzel ("Perspectives for Dye-sensitized Nanocrystalline Solar Cells").

Regarding claim 61, modified Gaudiana '959 discloses all the claim limitations as set forth above.

While modified Gaudiana '959 does disclose a ruthenium dye is adsorbed on the respective porous photoelectric conversion layers of the first photoelectric conversion elements (Chiba - [0113]), modified Gaudiana '959 does not explicitly disclose wherein a ruthenium dye defined by the formula:

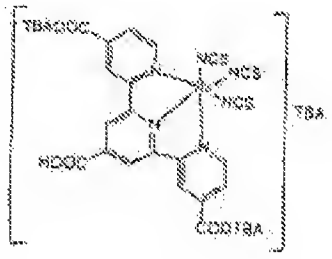


Nazeeruddin discloses a dye-sensitized solar cell and further discloses wherein N719 dye is adsorbed on a porous photoelectric conversion layer of a photoelectric conversion element (P8983/Chart 1).

Gaudiana '959 and Nazeeruddin are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the ruthenium dye disclosed by Nazeeruddin as the ruthenium dye disclosed in modified Gaudiana '959, because the choice amounts to one from among a limited number of possible dyes for use in dye-sensitized solar cells to achieve a known, predictable result.

Modified Gaudiana '959 does not explicitly disclose a black dye defined by the formula:



is adsorbed on the respective porous photoelectric conversion layers of a plurality of the second photoelectric conversion elements.

Grätzel discloses a dye-sensitized solar cell and further discloses a black dye adsorbed on a porous photoelectric conversion layer of a photoelectric conversion element (Figure 3).

Gaudiana '959 and Grätzel are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the black dye disclosed by Grätzel as the second dye disclosed in modified Gaudiana '959, because the choice amounts to one from among a limited

number of possible dyes for use in dye-sensitized solar cells to achieve a known, predictable result.

15. Claims 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai et al. (US 6,310,282) in view of Wanlass (US 5,322,572).

Regarding claims 32 and 34, Sakurai discloses a dye-sensitized solar cell module comprising: first photoelectric conversion elements each comprising a transparent conductive layer (C6/L55-56), a porous photoelectric conversion layer adsorbing a dye (C6/L56-50), an electrolytic layer (C6/L60), a catalyst layer (platinum - C8/L6), and a conductive layer (C6/L62) laminated in this order on a transparent substrate (505, C9/L21); second photoelectric conversion elements (C18/L28) each comprising a transparent conductive layer (C6/L55-56), a catalyst layer (platinum - C8/L6), an electrolytic layer (C6/L60), a porous photoelectric conversion layer adsorbing a dye (C6/L56-50), and a conductive layer (C6/L62) laminated in this order on a transparent substrate (505, C9/L21); a supporting substrate formed on the respective conductive layers of the first and second photoelectric conversion elements (71, Fig. 5), wherein one first photoelectric conversion element and one second photoelectric conversion element are alternately arranged in parallel between the transparent substrate (89, Fig. 5) and the supporting substrate (71, Fig. 5), and the neighboring first photoelectric conversion elements and second photoelectric conversion elements are electrically connected in series (C18/L28); a side of the transparent substrate is a light receiving side and a side of the supporting substrate is a non-light receiving side (C17/L42).

Sakurai does not explicitly disclose the first photoelectric conversion elements and the second photoelectric conversion elements are different in at least one among the composition of the electrolytic layers; the thickness of the porous photoelectric conversion layers; the width of the porous photoelectric conversion layers; the average particle diameter of the semiconductor particles composing the porous photoelectric conversion layers, in order that the first and second photoelectric conversion elements provide the same amount of electric currents.

Wanlass discloses a photovoltaic device and further discloses differing the width of photoelectric conversion layers in series connected solar cells in order to match electric current (C8/L49-51 - solar cell can be optimized by adjusting the areas of the subcells to match current densities of the two subcells).

Sakurai and Wanlass are combinable because they are concerned with the same field of endeavor, namely photovoltaic devices.

It would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the width of the photoelectric conversion layers of Sakurai in order to match the current, as disclosed by Wanlass, because as taught by Wanlass a solar cell can be optimized by adjusting the areas of the subcells to match current densities of the two subcells (C8/L49-51).

Regarding claim 33, modified Sakurai discloses all the claim limitations as set forth above.

While Sakurai does disclose that the sensitizing dye in the layer which is located more remote from the light incident side should preferably be constituted by a dye

exhibiting proportionately longer absorption wavelength (C17/36-39), Sakurai does not explicitly disclose wherein a short-circuit current of the second photoelectric conversion elements in the case where a light receiving face thereof is set in the porous photoelectric conversion layer side opposite the catalyst layer side is greater than a short circuit current of the first photoelectric conversion elements in the case where a light receiving face thereof is set in the porous photoelectric conversion layer side opposite the catalyst layer side.

However, the short circuit current produced by each of the first and second photoelectric conversion elements disclosed by Sakurai are dependent on the incoming wavelength of light to the device. Therefore, the device of Sakurai meets the limitations of the claim in conditions where the wavelength of incoming light is absorbed to a greater degree in the second photoelectric conversion elements than in the first.

Response to Arguments

16. Applicant's arguments filed March 24, 2011 regarding the Wanlass reference have been fully considered but they are not persuasive. Specifically, applicant argues that the teaching of Wanlass does not relate to dye-sensitized solar cells modules. In response to applicant's argument, Wanlass discloses that a solar cell can be optimized by adjusting the areas of the upper and lower subcells to match the current densities of the two subcells. Even if Wanlass discloses that the subcells are crystalline semiconductor p-n junction solar cells rather than dye-sensitized solar cells, one of ordinary skill in the art at the time of the invention would apply the teaching or

suggestion disclosed by Wanlass to any type of solar cell because all solar cells rely on light reaching a surface area and, regardless of the type of solar cell, the amount of light reaching a solar cell is related or proportional to the surface area of the solar cell. Therefore, the concept taught by Wanlass of adjusting areas of series connected cells to match current is applicable to the solar cells taught by Sakurai and Guadiana.

17. Applicant's remaining arguments with respect to claims 32-57 and 60-61 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TAMIR AYAD whose telephone number is (571)270-1188. The examiner can normally be reached on Monday through Friday, 7:30 AM - 4:00 PM.

19. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on 571-272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/T.A./
Examiner, Art Unit 1725
5/24/2011

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 1725